

01. Production Technology of Rice

Origin: India or Burma.

Environmental Requirements:

- Tropical, subtropical and temperate region.
- Average temperature for life period 21°-38°C.
- Temperature for seed germination 30°-35°C.
- Temperature for ripening 20°-25°C.
- Relative humidity 70-80%.
- Prolong sunshine, assure supply of water, rainfall 200cm/annum.
- Soil clay to clay loam. $P^H > 4-7$. Rice prefer acid soil. Optimum $P^H > 5.5-6.5$.

Variety:

Aus- BR 1, BR 8, BR 21, BRRI 43, BRRI 48, BRRI 55 etc.

Amon- BR 11, BR 22, BR 23, BRRI 25, BRRI 53, BRRI 56, BRRI 57 etc.

Boro- BR 17, BR 19, BRRI 55, BRRI 58, BRRI 29, BRRI 28 etc.

Land preparation (*For Aus*):

The field should be prepared by 4-5 ploughing, cross ploughing with laddering.

- **Seed rate-** 100 kg/ha.
- **Time of sowing-** March-April.
- **Method of sowing-** Broadcasting.

Fertilizer application (*For Aus*):

Urea-120 kg/ha

TSP-75 Kg/ha

MoP-60 kg/ha

Gypsum-60 kg/ha

ZnSO₄ -10 kg/ha

Total TSP, MoP, Gypsum, ZnSO_4 and $\frac{1}{4}$ urea should be applied during final land preparation. The remaining $\frac{1}{2}$ urea are equally split and top dressed at 35-40 DAS (Days After Sowing) and at 50-55 DAS.

Weeding (*For Aus*):

2-3 weeding is necessary start from very beginning of the growth stage *Benthiocarp* @ 2 kg/ha should be applied 6-7 days after seedling of rice. It should be followed by one manual weeding at 40-45 DAS.

Irrigation:

It is rain fed but if need one irrigation is done.

Raising seedling of transplant *amon* or *Boro* rice:

Seedling of rice raise in seed rate. There are several types of seed bed. These are (i) dry seed bed, (ii) wet seed bed, (iii) floating seed bed and (iv) dapog seed bed.

For dry seed bed, the land should be prepared by several ploughing, cross ploughing along with laddering. Then the seeds are to be sown.

For wet seed rate, after supplying of water. The land should be puddled by several ploughing, cross ploughing with laddering. Then sprouted seed are to be sown.

Size of seed bed:

500 m² seed bed is required for 1 hectare of main land.

Preparation of main land for transplanting *amon* and *boro*:

After supplying water land should be prepared by 5-6 ploughing and laddering. Land should be well leveled and removed of weeds and stubs. Pudding is done by country plough or power tiller.

Uprooting of seedling:

The seedling may be uprooted from the seed bed when they are suitable for transplanting. The seed bed should be moistened by application of water so that root system isn't damaged.

Age of seedling:

30-35 old days seedling for T-*amon* rice and 40-50 for *Boro* rice.

Time of transplanting:

July-august for T-amon transplanting. ***December-January*** for Boro rice.

Method of transplanting:

Planting in line is better but haphazard planting may be done, if adequate population is assured. In normal condition 2-3 seedling/hill and for late planting 7-8 seedling /hill should be planted.

Depth of transplanting:

2-3 cm, *spacing*- 25cm X 15cm.

Fertilizer application:

****for HYV T-amon rice-***

Urea- 180 kg/ha

TSP- 100 kg/ha

MoP- 70 kg/ha

Gypsum- 60 kg/ha

ZnSO₄ - 10 kg/ha

****For Boro rice-***

Urea- 200 kg/ha

TSP- 100 kg/ha

MoP- 80 kg/ha

Gypsum- 60 kg/ha

ZnSO₄ - 10 kg/ha

Total TSP, MoP, Gypsum, ZnSO₄ and 1/3 urea should be applied during final land preparation and the remaining 2/3 urea equally splitted and applied at 25-30 DAT (Day After Transplanting) and at 50-55 DAT.

Water Management (*Boro and Amon rice*)

Water requirements is high during initial seedlings period covering about 10 days. Early tillering and flowering is the most critical stage. Until transplanted seedlings are well established, water should be allowed to stand in the field at a depth of 3-5 cm. There after about 7-10 cm water may be maintained at early tillering and

12-15 cm water after maximum tillering stage. Ensure enough water from penicillate initiation to flowering stage. Alternate irrigation and drying are at best. Water should be drained out 7-15 days before harvest.

Weeding

2 weeding can be done. First at 15-20 DAT (before top dressing to urea) and Second at 50-60 DAT (before second top dressing). A number of herbicides has been found, effective in controlling weeds. These herbicides are *Stam F-34*, *Machete*, *Ronstar* etc. It should be applied within 7 DAT.

Insect pest and disease Control

The important insect pests are *stem borer*, *gall fly*, *Rice hispa*, *Leaf roller*, *Earhead cutting caterpillar*, *grasshopper*, *Mole cricket*, *Brown plant hopper*, *White backed grasshopper*, *green leaf hopper*, *Ghundi bug* etc.

General Control Measure

- Cultivation of resistance variety.
- Attractive by light trap.
- Collection of eggs, larvae, pupa and destroy them.
- Peg the bamboo stick (kunchi) into the soil in the rice field to sit birds on it for preying insect.
- By pearcing method.
- Burn on stubbles.
- Drained out stagnant water.
- Spray the crop with-
 - a. *Phosphamidon 100 EC* stem borer and gall fly.
 - b. *Dimethiod 40 EC* for rice hispa,
 - c. *Fozalon 35 EC* for grasshopper,
 - d. *DDVP 100 EC* for earhead cutting caterpillar,
 - e. *Malathion 57 EC* for leaf roller, BPH, green leaf hopper and gandhi bug.

Diseases

The important diseases are found in the rice field are *Blast, brown spot, sheath blight, Bacterial leaf blight, Bacterial leaf streak, False smut, Ufra, Bakane, Tungro etc.*

Control Measures

- Use disease free seed.
- Cultivation of disease resistant variety.
- Collecting and burning infected plant.
- Used balanced fertilizer
- Avoid standing water.
- Spray the crop with **Copper oxichloride, benlate, Humay, Toxid, Anosan.**

Harvesting

Maturity Symptoms-

- The green colour of the plant and grains turn into yellow or straw colour.
- By observing Characteristic colour of grain for a particular variety.
- By means life duration of crop.
- When moisture content grain about 20-25%.
- The grain will be hard, if pressed with finger.
- The right stage of harvesting is when about 80% panicle have about 80% ripen spikelets.

Method- The crop generally cut with sickle by hand. The plant should be cut quite close to the ground. They should collect in bundles and stock for threshing.

Post harvest operations

Threshing- The most common method of threshing are bullock, reaping with bare human foot, lifting the bundle and striking them on raised wooden platforms, pedal thresher, Motor driven thresher may also be used.

Cleaning and Winnowing- After threshing separation of grain from stubbles and clean it by winnow.

Drying and Storage- Then it is sun dried. After completion of drying wet grains and

store in its bags or godown. 12-14% moisture are safe for storing.

Yield

- Local variety 2.50-3 ton/ha.
- High yielding variety 4-6 ton/ha.
- Hybrid variety 6-9 ton/ha.

02. Production Technology of Wheat

Species

1. *Triticum aestivum*. (Bread)
2. *T. dicoccum*. (upmav, upma)
3. *T. durum*. (Suji, semay, macaroni)

Common name: Wheat.

Scientific name: *Triticum aestivum*.

Origin

South western Asia.

Environmental Requirements

- It can be grown in tropical, Sub-tropical and temperate region.
- Optimum temperature for seed germination 20-25°C.
- Above 25°C, tends to suppressed grain weight.
- 15-20°C is optimum for ripening.
- Rainfall 40-110 cm
- Soil- Loam to sandy loam soil with good structure. Moderate water holding capacity.
- pH 6.5-7.5
- Wheat is long day plant, the total life cycle 100-120 days.

Variety

Sonalika, Pavan, Akbar, Kanchan, Barkat, Abraham, Kalaynsona, Sanora, Protiba, Balaka, A
grahani, Saurav (BARI ghom 19), Gourab (BARI ghom 20), Satabdi (BARI ghom
21), Sufi (BARI ghom 22), Bijoy (BARI ghom 23), Prodip (BARI ghom 24), BARI

25,26,27,28.

Land Preparation

The land should be prepared by 4-6 ploughing, cross ploughing and laddering.

Seed Rate

- 110-120 kg/ha (Irrigated)
- 100 kg/ha (Rainfed)

Time of Sowing

- 10 November-15 December.
- Optimum time 15 November-30 November.

Method of Sowing- Broadcasting but line sowing is better.

Spacing- 25 cm (line-line)X 4 cm (plant-plant).

Seed Treatment- Seed should be treated with Vitavax 200@ 3 gm/1 kg seed.

Fertilizer Application

Fertilizer name	Irrigated/ha	Rainfed/ha
Cowdung	7-10 ton	7-10 ton
Urea	180-200 kg	140-180 kg
TSP	140-180 kg	140-180 kg
MOP	40-50 kg	30-40 kg
Gypsum	100-120 kg	70-90 kg

1/3 Urea and all other fertilizer are applied during final land preparation. The rest 2/3 Urea are equally splitted and apply 1st at 20 DAS and last at 55-60 DAS.

Intercultural Operations

Weeding- 1-2 weeding can be done to keep the land free from weeds. Weeding to be done before fertilizer application.

Irrigation- 2-3 irrigation can be given 1st at 20 DAS, 2nd at flowering stage and last at grain formation stage.

Precaution- Different kinds of birds are to be chased from the field upto 5-6 days or after sowing.

Insect Pest and disease control

Important insect are *Stem borer, aphid and cutworm*.

Control

Spray the crop with *Malathion 57 EC* for aphids, *Diazinon 60 EC* for stem borer *and Furadan 5g* for cutworm.

Disease

Important disease are *leaf rust, loose smut, seedlings blight and leaf spot*.

Control

- Seed should be treated with Vitavax 200@ 3 gm/1 kg seed.
- Spray the crop *with Tilt 250 EC*.

Harvesting

Maturity Symptoms

- The leaf of the plant should be die. The whole plant will be golden yellow.
- Grain will be golden brown in colour.
- Crunching sound will produce, if the grains are cut with teeth.
- Moisture Contents 20-25%.
- It matured 100-120 DAS.

Method- Harvesting is normally done with sickle by hand. Harvester can also be used.

Post harvest Operations

Threshing- After harvesting, the crop by hand, it is dried for 3-4 days on thresher floor. Threshing are done by bullock. Nowadays, power driven, Stationary thresher are also used.

Cleaning and Storage- For safe storage, grain should be cleaned and drying well in sun for few days so that moisture content 10-12%. After complete of drying weight the crops and stored it in bags.

Yield

3.5-5 ton/ha.

03. Production Technology of Maize

Bangla name: Bhutta

English name: Maize drcorn.

Scientific name: *Zea mays*.

Family: Gramineae.

Life cycle: 150-155 days.

Economic importance

It is used as human food, also as poultry feed and fodder crop. Alcohol and edible oil is prepared from maize. Also prepared board paper.

Origin

Central America, Mexico and Pakistan.

Environmental Requirements

- It is a crop of warm weather.
- Temperature- 21⁰ C for germination and 32⁰ C for growth.
- Rainfall- 25-500 cm but sensitive to stagnant water.
- Soil- All type of soil but well drained sandy loam to loam soil is best.
- pH - 5.5-7.5.

Variety

Local variety- Savar, DMR, JC.

Improve variety- Bornaly (BARI maize 1), Suvro (BARI maize 2), Mohar, Ambercop (khoi bhutta), Suwan 1, Suwan 2, BARI bhutta 5, BARI bhutta 6.

Hybrid Variety- BARI Hybrid Bhutta 3, 8, 9, 10, 11.

Land preparation

Land should be prepared 4-5 ploughing and laddering. The field should be properly levelled.

Fertilizer Application

Urea- 275-300 kg/ha.

TSP- 175-200 kg/ha.

MOP- 100-125 kg/ha.

Gypsum- 125 kg/ha.

ZnSO₄- 10 kg/ha.

1/3 urea and all other fertilizer should be applied during final land preparation. 2/3 Urea are equally splitted applied at 35-40 DAS and 65-70 DAS.

Sowing

Time- Robi: 15 October- 15 November.

Kharif-I: 15 February-April.

Kharif-II: July.

Method- 60-75 cm X 25-30 cm spacing. But it can be sown as broadcasting.

Depth- 25-35 cm.

Seed Rate- 25-30 kg for grain.

5-100 kg for fodder.

Seed Treatment- Seed should be treated with Agrosan GN and Granosan M.

Intercultural Operation

Gap filling- gap filling is done at at 7-10 DAS.

Thinning- When plant attain a height of 5-10 cm, it should be thinned out at 10-15 DAS.

Weeding- 2 weeding can be done.

Earthing Up- The soil in between the line should be earthup at the base of plants.

Irrigation- 2-3 irrigation are needed, 1st at 35-40 DAS, 2nd at 65-70 DAS and 3rd at 90-95 DAS.

Insect pest and disease Control

Important insect are *Earwarm*, *Borer*, *aphids*.

Control

- Seed should be treated with Agrosan GN and Granosan M.
- Use resistance variety.
- Spray crop with Malathion 57 EC or Fiponon 57 EC for Earwarm and aphids.

- Spray Sumithion/ Diazinon 57 EC for borer.

Disease

Important disease are *Leaf blight*, *Maize streak*, *maize mosaic virus*.

Control

- Use resistance variety.
- Remove the infected plant.
- Spray copper oxichloride/Macuprax.

Harvesting

Maturity Symptoms

- Colour of crops become straw colour.
- Leaf become slightly yellow.
- Black spot are seen at the base of seed.
- Grain become hard.

Method- Mature crop should be harvested by hand and dried in the sun for 3-4 days. Finally the seeds are to be separated by corn sheller or hand or cattle.

Yield-

- Local variety 2-3 ton/ha.
- High yielding variety 4-5 ton/ha.
- Hybrid variety 5-6 ton/ha.
- 10,000 crop/ha for boiling or roasting.

04. Production Technology of Tobacco

Scientific name: *Nicotiana spp.*

Species: *Nicotiana tabacum*

Nicotiana rustica.

Family: Solanaceae.

Economic Importance

1. It is a relaxing material to the tired people.
2. It is a social custom to entertain the guest all over the world.
3. It is the top most and widely used narcotic crop in the world.
4. It is cash crop of Bangladesh.
5. It is used as cigarette, Biri, churut, snuff, hukka, chewing materials, wrapper etc.
6. Nicotine extracted from tobacco can be used as insecticides.
7. It is a source of earning revenue of the government.
8. Many people live on tobacco business.

Distinguish between *Nicotiana tabacum* and *N. rustica*-

<i>N. tabacum</i>	<i>N. rustica</i>
Plant is taller.	Plant is shorter.
Leaves are large but narrow, they may be sessile and petioled.	Leaves are large, broad and ovate in shape, always petioled.
The colour of flower is reddish, pinkish or white.	The colour of flower is greenish to yellow.
It is used extensively for smoking and chewing purpose.	It is used extensively for hukka, chewing and snuff.

Origin

- a. *N. tabacum*- Argentina.
- b. *N. rustica*- Peru.

Environmental Requirements

- It is a tropical crop.
- 27-32°C temperature for germination of seed.
- 10-35°C temperature for growth.
- Around 25°C for maturity.

- Relative humidity 80%.
- Rainfall 110-115 cm/annum.
- Soil- Heavy, naturally fertile and acidic soil having P^H 5.5-6.5.

Variety

Cigarette- Horizon special, NC-15, Tarinco, Sesmaria, BAT-1, White burley, Burley-21, Yellow special, Virginia gold, Bonanja, Sugondi (nicotine free), Surovi.

Churut- Sumatra, New sumatra, Jamaica wrapper, Manila, Havana, TJ-448A, Ohio, Connecticut.

Hukka- Bhengi, Surjamukhi Bhengi, Motihari, T-28, T-50, Zati, Noakhul.

Biri- Kelio-19, Pelio, Nepani, Gandio, BD520/2.

Preparation of Nursery Bed

High land with well aeration and sunshine near water body.

Size of Nursery bed

- 3m X 1.2 m
- Height- 15 cm
- Six seedbed require to produce 1 hectare of land.

Fertilizer for 1 seedbed- Urea- 50-60 gm/bed.

K₂SO₄ - 25-30 gm/bed.

Compost of Cow dung- 2-3 kg/bed.

Seed Rate

- 12-15 gm/bed.
- As the seeds are very small (10,000-12,000 = 1 gm). So seed should be mixed (10-15 times) with ash or sands for uniform distribution and proper germination.

Time of Sowing in Nursery bed

- Optimum time is 15 August.
- But Mid August-mid September also be sown.

Protection of Seedlings

To protect the germinated seeds from rain and sunshine, covering is necessary above 20-30 cm.

Age of seedlings

6-8 weeks old seedlings, when attain a height of 8-10 cm is suitable for transplanting.

Preparation of land

5-6 times ploughing and laddering, the land should be levelled properly.

Uprooting of seedlings

A few hours before transplanting, Nursery bed should be well watered to facilitated easy uprooting of seedlings.

Transplanting time

mid October - mid November, transplanting should be done in the late afternoon to avoid the heat of sun.

Spacing- 75 cm X 60 cm. Immediately after transplanting, irrigation should be given.

Fertilizer Application

N- 50 kg/ha use as Urea

P₂O₅- 50 kg/ha use as TSP

K₂O- 15 kg/ha use as K₂SO₄.

1/2 kg Urea and all other fertilizer should be applied during final land preparation and rest 1/2 Urea should be applied at top dressed at 45 DAT.

Intercultural Operation

Weeding- Field should be weeded twice or thrice time.

Irrigation- 2-3 irrigation is enough. After irrigation, drainage must be done.

Topping- Consist in breaking off the top or crown of the plant at about the third branch below the flower head. This practice stimulate the development of leaves. Tobacco plants are topped to keep remaining them free from producing seed. And force the synthesized carbohydrate and nitrogen materials to remaining in the leaves for further growth and development. The top leaves that are remove are height in nicotine content. Topping results in larger, thicker and darker leaves that

mature earlier and more uniformly than untop plant. It is very important operation for the quality of tobacco leaves.

Suckering/de-suckering- After the tops have been removed, the buds in the axis of the leaves which remain dormant become active and sucker soon develop in the axis of the leaves. This sucker of lateral branches should be removed by hand before they become large enough to retard the development of leaves. Removal of this sucker is called Suckering/de-suckering.

Insect pest and disease Control

Insect- Important insects are *Cutworm, leaf caterpillar, Stem borer and aphids*.

Control

- Stem borer affected seedlings should be removed and destroyed.
- Spray crop with carbaryl 50% WP or neem cake powder.
- Fumigated with aluminium phosphate tablet.

Disease- Tobacco Mosaic virus, leaf curling, wilting, damping off, blank shank, frog eye, leaf spot, powdery mildew, anthracnose, root knot, Orobanche.

Control

- Use raised seedbed with adequate drainage.
- Rubbing the seedbed with paddy husk in 15-20 cm thick layer.
- Remove disease affected leaves and seedlings and destroy them.
- Spray the crop with Redomil 0.1%, benlate 0.5% and Bordeaux mixture 0.4%.

Harvesting

Maturity Symptoms-

- When the normal green colour of leaves changes to yellowish green.
- It will develop sticky substances on leaves.
- Leaves will stiffen.
- Development of yellow spot on leaf.

Time- Generally 4-4.5 months after transplanting.

Methods-

1. Priming- In tobacco generally lower leaves mature first followed by upper one's. Therefore, the harvesting of leaf is done by removing a few leaves, When they matured. This method of harvesting is called priming. In this method harvesting start from bottom and each time 2-4 leaves are harvested at interval of 5-10 days. The entire harvest is completed in 5 priming. The harvested leaves are placed in Basket and conveyed to the curing barn.

2. Stock cutting- In this method, the entire plant is cut closed to the ground with sickle, Saw, Hatchet, knife or special shares and left over night in the field for wilting. This method saves the labour.

Curing of Tobacco

After tobacco is harvested the leaves are cured. The curing is a process by which harvested tobacco leaves are made ready for market. It is essentially a drying process where by most of the moisture of the leaf is removed. Curing is done in order to impart the require colour, texture and aroma to the product. There are 4 curing method-

1) Flue Curing.

2) Air Curing.

3) Fire Curing.

4) Sun Curing.

1) Flue Curing- The harvested leaves are strung on sticks which are then stacked into a flue curing barn. The barn is artificially heated by flues(pipe) of hot air. Hot air produced from a furnace is conveyed to the barn through flues and the temperature is observed by a thermo meter. After harvesting the leaves tied into 'hands' of 4 leaves. About 14-15 hands are hung on the bamboo sticks. The green leaves should be loaded in the upper half of the barn and the lighter one's in the lower half. This process consists of 3 stages-

I) Yellowing- Leaf is kept at a high temperature (32-35°C) and high humidity for a about 30-40 hours till it attain a bright lemon yellow colour.

II) Fixing colour- After Yellowing the temperature raise gradually and humidity of barn is lowered by opening the ventilators. It is raised by not more than 1-2°F every hour. With rapid rise of temperature, when the leaf is still wet, result in a bluish black discolouration called scalding. It take about 16-24 hours.

III) Drying- The ventilators are closed and temperature is again gradually raise upto

160⁰ F to dry the veins and mid ribs of the leaves. It takes about 28-42 hours. This completes the process. Now ventilators are open to cool down the barn. The leaves are left in barn over night for absorbing moisture and to come to normal condition for handling and storage.

2) Air Curing- Tobacco leaves are divided into groups according to their size and strung on a string secured on a bamboo stick. Then the leaves are sheltered from wind and sun in a well ventilated barn. Where the leaves air dry for 6-8 weeks. Leaves colour changes from green to yellow.

3) Fire Curing- In fire curing smoke from a low burning fire on the barn floor permits the leaves. This give the leaves smoky aroma and flavor. Fire Curing takes 3-10 weeks.

4) Sun Curing- It can be done in different ways-

a) After initial wilting in the field, plants are strung on bamboo poles and cured in the sun. It takes about 15-20 days.

b) The leaves are allowed to dry in the sun on the ground and are turned over twice a day. This process continues for a week and then heaps are made which are opened the next day and re-heaped. This process of heaping, opening of heaps, spreading re-heaping continued 10-15 days.

c) Once the tobacco is cured workers tie it into small bundles of about 20 leaves called hands or use a machine to make large block called bales. The hand/bales are carefully aged for 1-3 years before being used in manufacture to improve flavor and reduce bitterness. By ageing nicotine is decreased and the aroma is increased.

Yield

300-900 kg/acre.

05. Production Technology of Lentil

Scientific name: *Lens culinaris* or *Lens esculentus*.

Origin

Egypt, South Europe and western Asia.

Environmental Requirements

Temperature 20-25⁰C, Dry climate.

Soil type- All type of soil but sandy loam to clay loam is best. PH 6.5-7.5.

Variety

Utfala, BARI Moshur 2, BARI Moshur 3, BARI Moshur 4, BINA 2, BINA3, BINA 5, BINA 6.

Sowing Time

Mid October to mid November.

Land Preparation

4-6 ploughing and laddering is need.

Seed Rate

30-35 kg/ha.

Fertilizer Application

N-25-35 kg/ha.

P₂O₅ -50-70 kg/ha.

K₂O- 20-25 kg/ha.

All fertilizer should be applied during final land preparation.

Intercultural Operation

Weeding- 2 weeding is suitable for lentil cultivation.

Irrigation- 1 irrigation can be given.

Harvesting Time

110-120 DAS.

Yield

1000-1300 kg/ha.

06. Production Technology of Mungbean

Scientific name: *Vigna radiata*

Origin

India, Burma, Thailand.

Environmental Requirements

Temperature 30-35°C.

Rainfall- 75-90 cm/annum.

All kind of soil but sandy loam to clay loam is the best.

Variety

BARI Mug 1, BARI Mug 2, BARI Mug 3, BARI Mug 4, BARI Mug 5, BINA Mug 1, BINA Mug 2, BINA Mug 3, BINA Mug 4, BINA Mug 5, BINA Mug 6, BINA Mug 7, BINA Mug 8.

Sowing time

March, April, October, August.

Land Preparation

2-4 ploughing and laddering will be done.

Seed Rate

15-25 kg/ha.

Fertilizer Application

N-20 kg/ha.

P₂O₅- 30 kg/ha.

K₂O- 30 kg/ha.

All fertilizer should be applied during final land preparation.

Intercultural Operation

Drainage is must.

Harvesting Time

75-80 DAS.

Yield

800-1000 kg/ha.

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